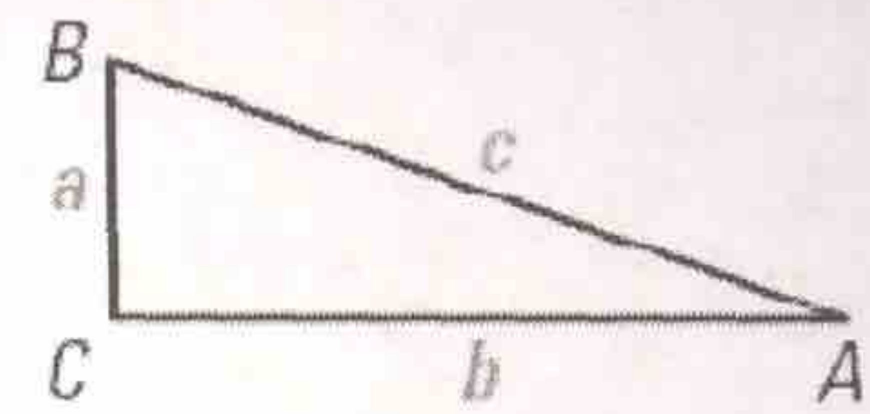
7.2 Use the Converse of the Pythagorean Theorem

THEOREM *For Your Notebook*

THEOREM 7.2 Converse of the Pythagorean Theorem

If the square of the length of the longest side of a triangle is equal to the sum of the squares of the lengths of the other two sides, then the triangle is a right triangle.



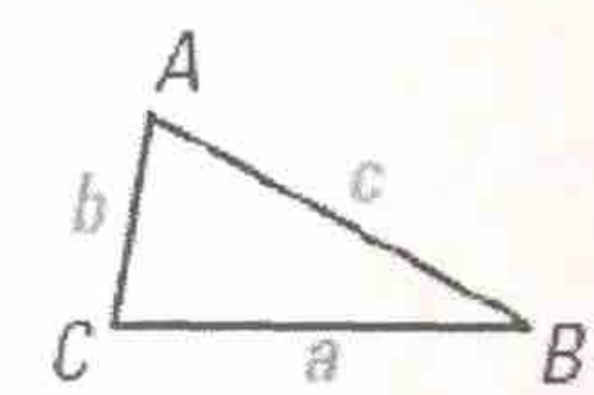
If $c^2 = a^2 + b^2$, then $\triangle ABC$ is a right triangle.

Proof: Ex. 42, p. 446

THEOREMS *For Your Notebook*

THEOREM 7.3

If the square of the length of the longest side of a triangle is less than the sum of the squares of the lengths of the other two sides, then the triangle ABC is an acute triangle.

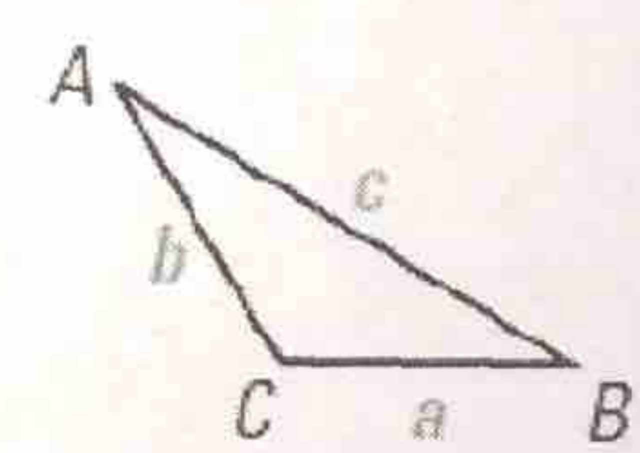


If $c^2 < a^2 + b^2$, then the triangle ABC is acute.

Proof: Ex. 40, p. 446

THEOREM 7.4

If the square of the length of the longest side of a triangle is greater than the sum of the squares of the lengths of the other two sides, then the triangle ABC is an obtuse triangle.



If $c^2 > a^2 + b^2$, then triangle ABC is obtuse.

Proof: Ex. 41, p. 446

Tell whether the given triangle is a right triangle.

Ex 1: 23, 11, 20

$a=11,\ b=20,\ c=23$

$a^2+b^2=c^2$

$(11)^2+(20)^2 \stackrel{?}{=} (23)^2$

$121+400 \stackrel{?}{=} 529$

$521 \neq 529$ $\boxed{\text{No}}$

Ex 2: 8, 10, $2\sqrt{41}$

$a^2+b^2=c^2$

$(8)^2+(10)^2 \stackrel{?}{=} (2\sqrt{41})^2$

$64+100 \stackrel{?}{=} (4)(41)$

$164 \stackrel{\checkmark}{=} 164$ $\boxed{\text{Yes}}$

Ex 3: Can segments with lengths of 4.3 feet, 5.2 feet, and 6.1 feet form a triangle? If so, would the triangle be acute, right, or obtuse?

① Triangle Inequality Theorem to check whether possible Δ:

$4.3+5.2 \overset{?}{>} 6.1$ $\quad$ $5.2+6.1 \overset{?}{>} 4.3$

$9.5 \overset{\checkmark}{>} 6.1$ $\quad$ $11.3 \overset{\checkmark}{>} 4.3$

$4.3+6.1 \overset{?}{>} 5.2$

$10.4 \overset{\checkmark}{>} 5.2$

$\boxed{\text{Yes, a } \Delta \text{ is formed}}$

② Classify Δ:

$c^2 \overset{?}{=} a^2+b^2$

$(6.1)^2 \overset{?}{=} (4.3)^2 + (5.2)^2$

$37.21 \overset{?}{=} 18.49 + 27.04$

$37.21 < 45.53$

$\boxed{\text{Acute } \Delta}$

Ex 4: Can segments with lengths of 15 inches, 20 inches, and 36 inches form a triangle? If so, would the triangle be acute, right, or obtuse?

Triangle Inequality Theorem:

$15+20 \overset{?}{>} 36$ $\quad$ $20+36 \overset{?}{>} 15$ $\quad$ $15+36 \overset{?}{>} 20$

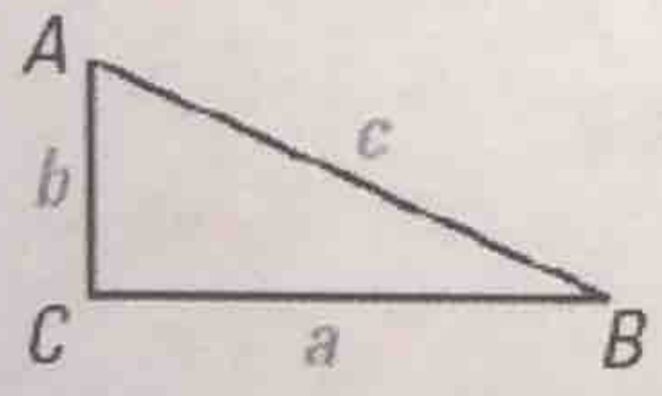
$35 \not> 36$ $\quad$ $56 \overset{\checkmark}{>} 15$ $\quad$ $51 \overset{\checkmark}{>} 20$

$\boxed{\text{Not a } \Delta}$

CONCEPT SUMMARY *For Your Notebook*

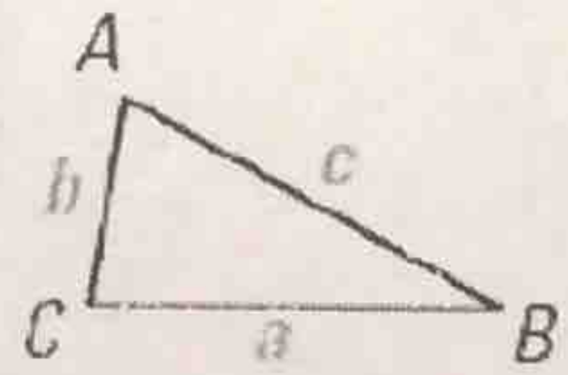
Methods for Classifying a Triangle by Angles Using its Side Lengths

Theorem 7.2



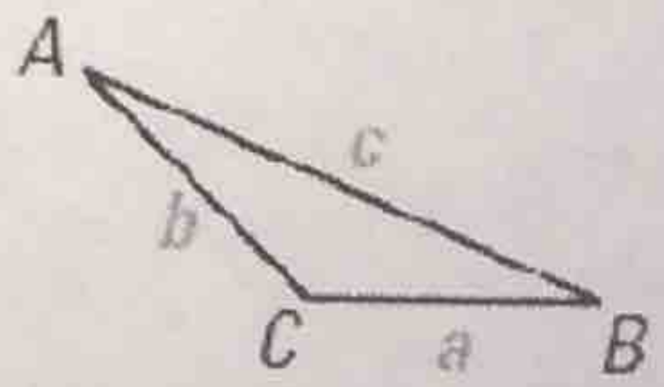
If $c^2 = a^2 + b^2$, then $m\angle C = 90°$ and $\triangle ABC$ is a right triangle.

Theorem 7.3



If $c^2 < a^2 + b^2$, then $m\angle C < 90°$ and $\triangle ABC$ is an acute triangle.

Theorem 7.4



If $c^2 > a^2 + b^2$, then $m\angle C > 90°$ and $\triangle ABC$ is an obtuse triangle.